REMARKS

Claims 1-7 are currently pending in the application; with claim 1 being independent. Claims 1-7 were pending prior to the Office Action. In this Reply, claim 1 has been amended.

The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein. Applicant respectfully requests favorable consideration thereof in light of the amendments and comments contained herein, and earnestly seeks timely allowance of the pending claims.

REJECTION OF CLAIMS UNDER 35 U.S.C. § 112, 1ST AND 2ND PARAGRAPHS

Claims 1-7 have been rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description. The Examiner alleged that the claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner alleged that the present application does compare wavefront aberration amount with a table prepared beforehand.

This rejection is respectfully traversed.

Applicant has amended claim 1 to recite: "measuring a wavefront of thus molded first temporary optical device and calculating a wavefront aberration amount $\underline{\Delta}$; calculating a correction wavefront aberration amount $\underline{-\Delta}$ compensating for the wavefront aberration amount $\underline{\Delta}$; designing <u>a second temporary optical device</u> for optimizing a form so as to exhibit a wavefront aberration with the correction wavefront aberration amount <u>$-\Delta$ without using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter</u>; and designing, according to the optimized form of the second temporary optical device, a normal molding die for molding a normal optical device."

Paragraphs [0032], [0034], [0035], [0041], [0044]-[0046], [0055] and [0056] of the present application describe:

> **[0032]** According to the wavefront aberration amount (Δ) calculated in the third step, ***a correction wavefront aberration amount ($-\Delta$) which can compensate for the wavefront aberration amount (Δ) is calculated***. (Emphasis added)

[0034] Optical designing of an aspherical lens is carried out by optimizing its form so as ***to generate a wavefront aberration with the correction wavefront aberration amount (-Δ)*** determined by the fourth step. (Emphasis added)

[0035] The optical designing in the fifth step is carried out by using the same technique as that of the first step mentioned above. ***Namely, optical parameters include at least the elements C, k, and A_{2i} (i = 2 to 5) for each aspheric surface in the above-mentioned aspheric surface expression, and the thickness of the lens, whereby at least 13 optical parameters exist in total as in the first step. On the other hand, the target is in such a form as to generate the wavefront aberration amount (-Δ).*** (Emphasis added)

[0041] Thus, according to the wavefront aberration amount (Δ) temporarily molded by the temporary die 1, ***a correction wavefront aberration amount (-Δ) which can compensate for the wavefront aberration amount (Δ) is calculated,*** and ***a lens which can generate the correction wavefront aberration amount (-Δ) is optically designed again in this embodiment.*** This can yield a normal die 11 which can favorably deal with the occurrence of unexpected aberrations and finally mold a lens having quite favorable aberrations. (Emphasis added)

[0044] First, a desirable aspherical lens is optically designed by optimizing its form so as to yield a wavefront aberration of 0 (S1), a die (temporary die 1) is designed and made according to the result of optical designing (S2), an aspherical lens is molded (temporarily molded) by using the die (temporary die 1) (S3), and the transmitted wavefront of thus obtained aspherical lens (temporary lens 2) is measured with an interferometer, ***so as to measure its wavefront aberration amount (Δ)*** (S4). (Emphasis added)

[0045] Subsequently, it is determined whether the measured wavefront aberration amount (Δ) is greater than a predetermined reference value or not (S5). If it is determined that the wavefront aberration amount (Δ) is greater than the predetermined reference value, ***a correction wavefront aberration amount (-Δ) which compensates for the wavefront aberration amount (Δ) is calculated (S6), and the flow returns to S1.*** (Emphasis added)

[0046] By using the same optical parameters as those in the initial optical designing with additional optical parameters if necessary, ***an aspherical lens is optically designed by optimizing its form such that its wavefront aberration coincides with the correction wavefront aberration amount (-Δ) (S1), a die (normal die 11) is designed and made according to the result of optical designing (S2), an aspherical lens is molded (finally molded) by using this die (normal die 11) (S3)***, and the transmitted wavefront of thus obtained aspherical lens (normal lens 12) is measured with an interferometer, so as to measure the wavefront aberration amount (Δ) (S4). (Emphasis added)

[0055] As explained in the foregoing, the optical device molding die designing method of the present invention measures a wavefront aberration amount (Δ) of an optical device molded by a temporary die, calculates a correction wavefront aberration amount (-Δ) which can compensate for the

wavefront aberration amount (Δ), ***optically designs the optical device again by optimizing its form so as to generate the correction wavefront aberration amount (-Δ)*** according to the same technique as with the initial optical designing, and designs a normal die accordingly. (Emphasis added)
[0056] Therefore, unlike the conventional technique in which an amount to adjust a die is simply determined by using a table according to a part of optical parameters, ***the present invention can yield a normal die which can favorably deal with the occurrence of unexpected aberrations and finally mold an optical device having quite favorable aberrations***. (Emphasis added)

The above-referenced paragraphs clearly support "measuring a wavefront of thus molded first temporary optical device and calculating a wavefront aberration amount Δ; calculating a correction wavefront aberration amount –Δ compensating for the wavefront aberration amount Δ; designing a second temporary optical device for optimizing a form so as to exhibit a wavefront aberration with the correction wavefront aberration amount –Δ without using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter; and designing, according to the optimized form of the second temporary optical device, a normal molding die for molding a normal optical device."

Claims 1-7 also have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite.

This rejection is respectfully traversed.

Applicant has amended claim 1 to recite: "measuring a wavefront of thus molded first temporary optical device and calculating a wavefront aberration amount Δ; calculating a correction wavefront aberration amount –Δ compensating for the wavefront aberration amount Δ; designing a second temporary optical device for optimizing a form so as to exhibit a wavefront aberration with the correction wavefront aberration amount –Δ without using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter; and designing, according to the optimized form of the second temporary optical device, a normal molding die for molding a normal optical device."

Thus, claim 1 clearly recites that a wavefront of the molded first temporary optical device is measured, a wavefront aberration amount Δ is calculated; a correction wavefront aberration amount –Δ is calculated for compensating for the wavefront aberration amount Δ; a second temporary optical device for optimizing a form is designed so as to exhibit a wavefront aberration with the correction wavefront aberration amount –Δ without using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter; and a normal molding die for molding a normal optical device is designed according to the optimized form of the second temporary optical device. Paragraphs [0030] and [0050] mentioned by the Examiner on page 3 of the Office Action do not describe using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter for designing a second temporary optical device.

In view of the above, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 112, first and second paragraph rejections of claims 1-7.

REJECTION OF CLAIMS UNDER 35 U.S.C. § 102 and § 103

Claims 1-7 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Kawakita (Japanese Patent Publication No. 2002-096344) or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over Kawakita in view of Davis et al. (USPN 3,434,781). The rejections are respectfully traversed.

Applicant has amended claim 1 to recite "measuring a wavefront of thus molded first temporary optical device and calculating a wavefront aberration amount Δ; calculating a correction wavefront aberration amount –Δ compensating for the wavefront aberration amount Δ; designing a second temporary optical device for optimizing a form so as to exhibit a wavefront aberration with the correction wavefront aberration amount –Δ without using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter; and designing, according to the optimized form of the second temporary optical device, a normal molding die for molding a normal optical device."

Kawakita discloses determining an amount to adjust the metal mold (correction wavefront aberration amount) to correct for the wavefront aberration deviation by comparing the wavefront aberration deviation with a table (e.g., Table T of Fig. 4) that has been prepared beforehand.

In Kawakita, a tentative mold 2 is formed on the basis of a predetermined shape design value and a tentative lens 1 is molded by the tentative mold, and the optical characteristics of the molded tentative lens are measured to be compared with desired optical characteristics to detect the shift quantity of the spherical aberration value thereof. The shift quantity of an aspheric aberration value shifted from the desired optical characteristics as a result of detection is collated with a table T preliminarily calculating the relation between the fine change quantity Ai of higher order among the aspheric surface constant Ai of a formula prescribing an aspheric surface and the variation quantity of the aspheric surface aberration value. The fine change quantity of higher order among the corresponding aspheric surface constant is determined as adjusting quantity and the adjusting quantity is added to the aspheric surface constant of the formula for prescribing the aspheric surface of the tentative mold to design a final mold as a new shape design value (English Abstract).

Kawakita does not design a second temporary optical device for optimizing a form so as to exhibit a wavefront aberration with the correction wavefront aberration amount $-\Delta$ without using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter.

Claim 1 recites that a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter is not used in the present invention.

In the present invention as recited in claim 1, designing is first performed according to an initial design target value A0 (a desirable wavefront aberration A0). A wavefront of a molded first temporary optical device is measured and a wavefront aberration amount Δ is calculated, which indicates that first temporary optical device has a design value of B0 with aberration $B0=A0 + \Delta$, which is different from A0. The initial design target value A0 is then changed to Al ($Al=A0 - \Delta$) and a second temporary optical device is then designed using a design target value A1 and based on the first temporary optical device. If the design-changed optical element (the

second temporary optical device) is thus designed and a molding die is accordingly designed, it is expected that a wavefront aberration of the formed optical device would be B1=B0 - Δ = (A0 + Δ) - Δ =A0 which is the design target value. Thus, in the present invention as recited in claim 1, a second temporary optical device is designed having a design target value Al=A0 – Δ, using a plurality of optical parameters, based on the wavefront aberration amount of the first temporary optical device.

The method of the present invention as recited in claim 1 is significantly different from the method shown in Kawakita. In Kawakita an adjustment quantity for a specific optical parameter is determined using a table prepared beforehand which shows a relationship between a changing quantity of a spherical aberration value (λ rms) and a minutely changed value for an aspheric surface constant Ai. Specifically, Kawakita uses a table T that preliminarily calculates the relation between a fine change quantity Ai of higher order among the aspheric surface constant Ai of a formula prescribing an aspheric surface and the variation quantity of the aspheric surface aberration value (English Abstract). Table T shows a correspondence relation between variation of a parameter (for example A4) when changing the parameter, and the amount of change in a spherical aberration value. For example, as illustrated in drawing 4 of Kawakita, a -0.5E-05 change in A4 corresponds to a 0.005 λ rms aberration change (drawing 4 and paragraphs [0027]-[0028]).

The method of the present invention, in which a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter is not used, is neither described nor suggested in Kawakita.

In Kawakita, a correction wavefront aberration amount –Δ compensating for a wavefront aberration amount is not calculated and a second temporary optical device is not designed using a plurality of optical parameters so that the optical device would exhibit this correction wavefront aberration value –Δ. In Kawakita, an adjustment quantity of the aspherical constant Ai prescribing a condition for molding a die is determined from a deviation amount of a spherical aberration value directly from a table prepared beforehand (Fig. 4 of Kawakita).

Advantages of the molding die designing method as claimed in claim 1 are as follows. In the present invention, since a second temporary optical device is newly designed so as to exhibit a correction wavefront aberration value –Δ compensating for the calculated wavefront

aberration, it is possible to adjust unfavorable conditions that include not only spherical aberration of low order but also, for example, spherical aberration of high order, focal length, working distance, astigmatism, image height characteristic (optical capability when an object which is not perpendicular to the optical axis is imaged), etc. In addition, unfavorable conditions which are unexpected at the initial designing step would be treated favorably in the present invention. Kawakita cannot achieve the advantages of the claimed invention because Kawakita can correct only expected unfavorable conditions (unfavorable conditions which are expected beforehand) because Kawakita uses the table prepared beforehand.

Furthermore, when a plurality of unfavorable conditions are corrected at the same time, another correction measure may be different from a case where only one unfavorable condition should be corrected. The present invention as recited in claim 1 can deal with such a situation as well, and correct for such a plurality of unfavorable conditions, since the correction wavefront aberration value $-\Delta$ is calculated after measuring the wavefront aberration value Δ while considering all types and kinds of unfavorable conditions. Thus, with the present method recited in claim 1, it is possible to perform aberration correction and designing when a plurality of unfavorable conditions are present, by using many types and kinds of parameters such as, for example, aspherical aberrations of high and low orders, curvature, center thickness, etc., and appropriate corrections would be taken against the plurality of unfavorable conditions.

Therefore, Kawakita fails to teach or suggest all of the elements for amended claim 1, and furthermore, Kawakita is not prior art to the claimed invention because Kawakita cannot achieve the advantages of the claimed invention.

Davis et al. does not discuss measuring a wavefront of thus molded first temporary optical device and calculating a wavefront aberration amount $\underline{\Delta}$; calculating a correction wavefront aberration amount $\underline{-\Delta}$ compensating for the wavefront aberration amount $\underline{\Delta}$; designing <u>a second temporary optical device</u> for optimizing a form so as to exhibit a wavefront aberration with the correction wavefront aberration amount <u>$-\Delta$ without using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter</u>; and designing, according to the optimized form of the second temporary optical device, a normal molding die for molding a normal optical device.

Davis et al. discloses at column 9, lines 54-60 (to which the Examiner refers):

> The preceding eight considerations or criteria in their order of priority (and as applied to two specific Rx lens values) also appear in a convenient tabulated form at the left side of the bar graph charts of FIGS. 6 and 7, and a convenient group of selected values for tolerances for the above criteria is given in the following table.

This description in Davis et al. is not related to any step of designing a second temporary optical device for optimizing a form so as to exhibit a wavefront aberration with the correction wavefront aberration amount $-\Delta$ without using a table prepared beforehand which shows a relationship between a deviation of the wavefront aberration amount Δ and a deviation of the optical parameter.

Therefore, Davis et al. fails to teach or suggest all of the elements for amended claim 1.

In view of the above, claims 1-7 are patentable over Kawakita and Davis et al., considered alone or in combination. The allowance of claims 1-7 is respectfully solicited.

CONCLUSION

In view of the above, Applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Corina E. Tanasa, Registration No. 64,042, at telephone number (703) 208-4003, located in the Washington, DC area, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§ 1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

#46,439

~~By~~

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